SECTION 3.7: GROUNDWATER

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on the groundwater resources within the DMC Unit. Information in this section was summarized from the Draft CVPIA PEIS, Groundwater, Technical Appendix, Volume 2 (Reclamation 1997b).

AFFECTED ENVIRONMENT

The southern two-thirds of the Central Valley regional aquifer system, which covers over 13,500 square miles and extends from just south of the Delta to just south of Bakersfield, is referred to as the San Joaquin Valley Basin (DWR 1975). Much of the western portion of this area is underlain by the Corcoran Clay Member, which divides the groundwater system into two major aquifers: a confined aquifer below the clay and a semi-confined aquifer above the clay (Williamson et al. 1989). Aquifer recharge to the semi-confined upper aquifer historically occurred from stream seepage, deep percolation of rainfall, and subsurface inflow along basin boundaries. With the introduction of irrigated agriculture into the region, recharge was augmented with deep percolation of applied agricultural water and seepage from the distribution systems. Recharge of the lower confined aquifer results from the subsurface inflow from the valley floor and foothill areas to the east of the eastern boundary of the Corcoran Clay Member.

Groundwater in the San Joaquin Valley has been heavily developed by pumping, largely for crop irrigation. Pumping has caused depressions to form as a result of subsidence and has altered regional groundwater flow patterns, recharge, and discharge. Annual groundwater pumping in the San Joaquin River region may often exceed estimates of perennial yield. All the subbasins within the San Joaquin River region have experienced some overdraft (CDWR 1994).

Land subsidence in the San Joaquin Valley has occurred mostly in areas that are confined by the Corcoran Clay, where pressure changes caused by groundwater pumping promote greater compressive stress than in the unconfined zone (CDWR 1977). The maximum land subsidence levels recorded in the Central Valley occurred within Fresno County. Land subsidence levels of as great as 30 feet have been measured in parts of northwestern Fresno County (Ireland et al. 1982).

As a result of land subsidence, increased pumping lifts, and water quality limitations, surface water was imported to the western valley to decrease groundwater pumping. Beginning in 1967, surface water imported via the California Aqueduct began to replace groundwater as the primary source of irrigation supply in the area south of the city of

Mendota. The availability of surface water led to an increase in the total quantity of water applied, whereas the quantity of water removed from the system by the wells decreased. The marked decrease in groundwater pumping has allowed a recovery in hydraulic head. The rise in the potentiometric surface from 1967 to 1984 was nearly one-half of the drawdown that occurred from predevelopment conditions to 1967.[1] Agricultural development also has affected the semi-confined zone. Increased rates of recharge resulting from percolation of irrigation water, combined with the rapid post-1967 decrease in pumping, caused a rise in the height of the water table over much of the western valley (Belitz and Heimes 1990).

Vertical groundwater flow is substantial in the western San Joaquin Valley. The combined result of pumping from below the Corcoran Clay and percolation of irrigation water from above the water table has been the development of a large downward flow gradient in the semi-confined aquifer and a groundwater flow divide in the western part of the valley (Belitz and Moore 1990).

GROUNDWATER QUALITY

Groundwater quality conditions in the San Joaquin River Region vary throughout the area. Total dissolved solids, boron, nitrates, arsenic, selenium, and dibromo-chloropropane are parameters of concern for agricultural and M&I uses in the San Joaquin River region. Of particular concern on the west side of the San Joaquin Valley are total dissolved solids and selenium.

Groundwater zones commonly used along a portion of the western margin of the San Joaquin Valley have high concentrations of total dissolved solids, ranging from 500 milligrams per liter (mg/L) to greater than 2,000 mg/L (Bertoldi et al. 1991). The concentrations in excess of 2,000 mg/L commonly occur above the Corcoran Clay layer. These high levels have impaired groundwater for irrigation and M&I uses in the western portion of the San Joaquin Valley. Contractors within the DMC Unit that have drainage-impacted lands have developed aggressive programs to manage salts in the root zone and to minimize deep percolation through the use of high-efficiency irrigation techniques, such as sprinklers, shortened rows, and installation of groundwater monitoring wells.

High selenium concentrations in soils of the west side of the San Joaquin River region are of considerable concern because of their potential to leach from the soil by subsurface irrigation return flow into the groundwater and into receiving surface waters (Bertoldi et al.

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[1] The potentiometric surface is defined as the level that water from the confined aquifer would rise to in a tightly cased well completed in the confined aquifer.

1991). Selenium concentrations in shallow groundwater along the west side of the region have been highest in the central and southern area south of the cities of Los Banos and Mendota, with median concentrations of 10,000 to 11,000 mg/L (Bertoldi et al. 1991).

AGRICULTURAL SUBSURFACE DRAINAGE

Inadequate drainage and accumulating salts have been persistent problems along the west side and in parts of the east side of the San Joaquin River region for more than a century. The most extensive drainage problems exist on the west side of the San Joaquin River and Tulare Lake regions. The soils on the west side of the region are derived from marine sediments and are high in salts and trace elements. Irrigation of these soils has mobilized these compounds and facilitated their movement into the shallow groundwater. Much of this irrigation has been with imported water containing salts, resulting in rising groundwater and increasing soil salinity. Where agricultural drains have been installed to control rising water tables, drainage water frequently contains high concentrations of salts and trace elements (San Joaquin Valley Drainage Program 1990).

In some portions of the San Joaquin River region, natural drainage conditions are inadequate to remove the deep percolation to the water table. This occurs because vertical conductivity is low and, therefore, limits downward drainage of infiltrated water. In addition, horizontal hydraulic conductivity is low and inhibits downslope subsurface drainage. Shallow groundwater levels often rise into the root zone, and subsurface drainage must be supplemented by constructed facilities for irrigation to be sustained (Reclamation and Service 1999).

ENVIRONMENTAL CONSEQUENCES

For purposes of this analysis, an adverse impact on the groundwater resources would occur if a long-term water service contract renewal:

- Results in the depletion of current groundwater resources
- Substantially alters the volume of groundwater available for beneficial use, or
- Causes groundwater now available for beneficial use to be unavailable because of contamination or physical obstruction

NO-ACTION ALTERNATIVE

Groundwater levels may decline 1 to 3 percent as a result of the allocation of CVP water to Level 2 refuge water supplies and improved fish and wildlife habitat. As a result, land subsidence could increase over its present rate.

Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that reduced CVP surface water is delivered, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. In addition, salt loading in soils and shallow groundwater would occur as a result of the application of the lower-quality groundwater. Soil salinity and saline subsurface water tables are being managed to maintain agricultural productivity through a combination of best management practices and the operation of subsurface drainage collection systems. With the reduced CVP water supply projected in the No-Action Alternative, drainage would not be expected to increase.

ALTERNATIVE 1

Alternative 1 could have impacts similar to those discussed above for the No-Action Alternative. Groundwater pumping and land subsidence will continue in the project area as they have historically. To the extent that deliveries of CVP surface water are reduced, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. In addition, salt loading in soils and shallow groundwater would occur. These impacts would be the same as the impacts for the No-Action Alternative.

ALTERNATIVE 2

Alternative 2 could have impacts similar to, but perhaps more pronounced than those discussed above for the No-Action Alternative. Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that less CVP surface water is purchased because tiered pricing starts at a lower percentage of contract deliveries, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. In addition, salt loading in soils and shallow groundwater would occur. These impacts would be the same as the impacts for the No-Action Alternative.

CUMULATIVE IMPACTS

Long-term contract renewals, when added to other past, present, and reasonably foreseeable future actions, could result in indirect impacts to groundwater resources by contributing to those factors that increase the reliance on groundwater pumping during those years when the price of surface water exceeds the costs of groundwater pumping. The extent and severity of these impacts will depend on many factors, including the availability and price of CVP water. First, the costs of pumping can increase as groundwater basins and aquifers are drawn down and can decrease as they recharge. Extensive drawdown of the aquifers can cause poorer quality from nearby zones to degrade the aquifers, but only if the pumping is so extensive as to remove hydrologic barriers to aquifer degradation. Extensive pumping can also exacerbate subsidence problems. The increased depth of pumping needed when aquifers are drawn down leads to increased lift/energy costs and, in some instances, can result in the need to resize pumps to access deeper groundwater. Similarly, the increased use of pumps resulting from a greater reliance on groundwater can accelerate pump equipment wear and tear and lead to earlier repair and replacement costs. These and related costs will need to be considered over the long-term and compared to the future annual prices of CVP water or water transfers to make the right economic decisions to pump or purchase surface water.